



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/679,004	10/02/2003	Michael J. Berman	03-0962/LSI1P232	8894

7590 09/28/2004  
LSI Logic Corporation  
1551 McCarthy Boulevard  
Milpitas, CA 95035

EXAMINER


TOLEDO, FERNANDO L

ART UNIT PAPER NUMBER

2823

DATE MAILED: 09/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/679,004	<b>Applicant(s)</b> BERMAN ET AL.	
	<b>Examiner</b> Fernando L. Toledo	<b>Art Unit</b> 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 02 October 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5-9, 12, 13 and 16-21 is/are rejected.
- 7) ☒ Claim(s) 4, 10, 11, 14 and 15 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Objections***

1. Claim 13 is objected to as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 13 recites, “to remove a majority of the dielectric matrix”. The word “majority” is indefinite since it leaves to speculation what majority means. Is more than half majority; is it two-thirds or three-fourths a majority? What constitute a majority?
2. Claims 4, 10, 11, 14 and 15 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

### ***Claim Rejections - 35 USC § 102***

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 18 – 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Sun et al. (US Patent Application Publication US 2003/0047541 A1).

In re claim 18, Sun, in the US Patent Application Publication US 2003/0047541 A1; figures 1 – 2B and related text, discloses a low-k dielectric film; and whisker reinforcement distributed throughout the film (Paragraph 0033).

Art Unit: 2823

4. In re claim 19, Sun discloses wherein the whisker reinforcements are selected from the group consisting of SiC, Si<sub>3</sub>N<sub>4</sub>, oxides, polymers, and diamond structured materials (Paragraph 0033).

5. In re claim 20, Sun discloses wherein the whiskers occupy a volume in the matrix in the range of 0.1 to 10% (Paragraph 0033).

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1 – 3, 5 – 9, 13, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woo et al. (U. S. Patent 6,531,777 B1) in view of Sun et al.

In re claim 1, Woo, in the U. S. Patent 6,531,777 B1; figures 1 – 5 and related text, discloses forming a dielectric matrix 34 on a semiconductor wafer 30.

Woo does not disclose distributing a reinforcing material including one of fibers and nanostructure whiskers throughout the dielectric matrix film to form the dielectric composite film.

However, Sun discloses distributing a reinforcing material including one of fibers and nanostructure whiskers throughout the dielectric matrix film to form the dielectric composite film to reinforce the low-k dielectric film (Paragraph 0033).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to distribute fibers or nanostructure whiskers throughout the dielectric matrix of Woo, since, as taught by Sun, the whiskers or fibers help reinforce the dielectric matrix.

8. In re claim 2, Woo in view of Sun discloses wherein the reinforcing material comprises nanostructure whiskers (Paragraph 0033 of Sun).

9. In re claim 3, Woo discloses wherein the dielectric matrix film is selected from the group consisting of SiO<sub>2</sub> and low-k dielectric layers (Column 3, Lines 7 – 10).

10. In re claim 5, Woo in view of Sun discloses wherein the reinforcing material comprises an insulating ceramic material (Paragraph 0033 of Sun).

11. In re claim 6, Woo in view of Sun discloses wherein the whiskers are rod-shaped and have a length in the range from 5 to 20 nm (Paragraph 0033 of Sun).

12. In re claim 7, Woo in view of Sun discloses wherein the whiskers have aspect ratios in the range of 5:1 to 300:1 (Paragraph 0033 of Sun).

13. In re claim 8, Woo in view of Sun discloses wherein the whiskers are randomly oriented (Paragraph 0033 of Sun).

14. In re claim 9, Woo in view of Sun discloses wherein the volume of the whiskers in relation to the volume of the matrix material lies in the range from 0.1 to 10% (Paragraph 0033 of Sun).

15. In re claim 13, Woo discloses further comprising etching the dielectric matrix film to remove a majority of the dielectric film matrix (Column 3, Lines 15 – 20).

16. In re claim 16, Woo discloses further comprising forming an inlaid conductive layer in the low-composite layer (Figure 4).

Art Unit: 2823

17. In re claim 17, Woo discloses wherein the inlaid copper layer is a copper dual-damascene interconnect structure (Column 2, Lines 60 – 64).

18. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Woo in view of Sun as applied to claims 1 – 3, 5 – 9, 13, 16 and 17 above, and further in view of Grill et al. (U. S. Patent 6,030,904).

Woo in view of Sun does not teach further comprising heating the dielectric matrix film to vaporize volatile components. However, Grill, in the U. S. Patent 6,030,904; figures 1A – 2F and related text, discloses annealing dielectric layers such as BCB to stabilize the low-k dielectric layer (Column 2, Lines 54 – 63).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to anneal the low-k dielectric layer of Woo in view of Sun, since, as taught by Grill, it annealing the low-k dielectric layer stabilizes the low-k dielectric layer.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fernando L. Toledo whose telephone number is 571-272-1867. The examiner can normally be reached on Mon-Thu 7am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

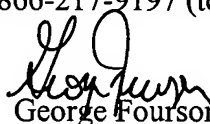
Art Unit: 2823

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



FToledo

27 September 2004



George Fourson

Primary Examiner

Art Unit 2823